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[54] **ENGINE STOP-START ELECTRICAL CIRCUIT**

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[52] **U.S. Cl.** ..... **307/10 R**; 123/DIG. 11; 123/198 D

[58] **Field of Search** ..... 307/10 R, 328; 322/10, 322/11, 7, 8, 62; 290/36 R, 37 R, 38 R, 40 R; 123/198 D, DIG. 11

[56] **References Cited**

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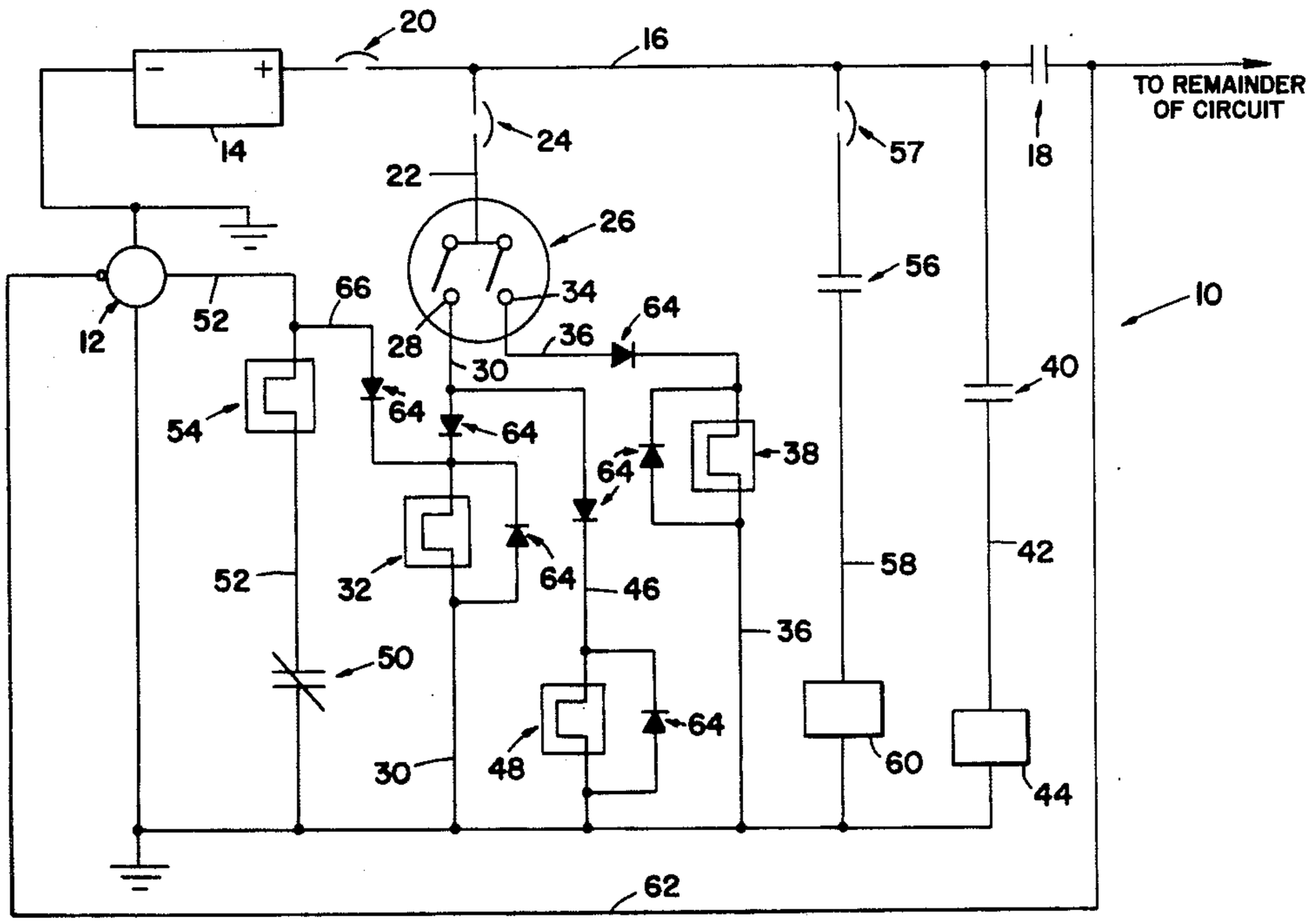
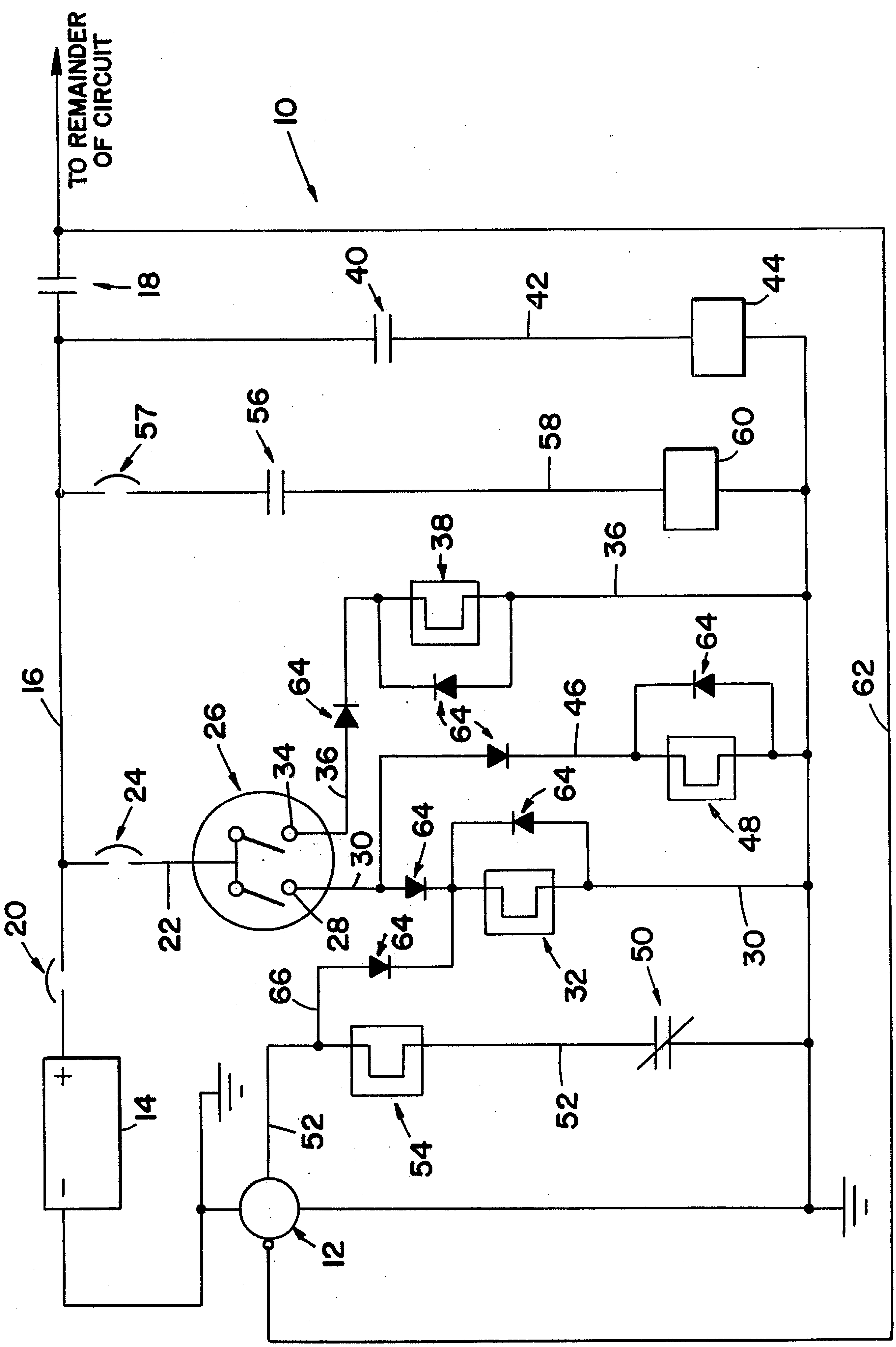
[57] **ABSTRACT**

An electrical circuit for use with an engine having an alternator has a relay to control a solenoid to properly shut down a diesel engine and includes openable and closable contacts for supplying power to another portion of the circuit, it being ensured that such contacts remain closed when either the vehicle key is in the on position or there exists an alternator output.

9 Claims, 1 Drawing Figure




TO REMAINDER OF CIRCUIT
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ENGINE STOP-START ELECTRICAL CIRCUIT

BACKGROUND OF THE INVENTION

This invention relates to electrical circuitry, and more particularly, to electrical circuitry for a vehicle including an engine.

In a vehicle including, for example, an internal combustion engine, such a vehicle generally includes electrical current generating means in the form of an alternator (or generator). The operator of the vehicle uses a key to operate a starter solenoid to start the engine, such key also being used to shut down the engine.

In the shut down of a diesel engine, the switch associated with the key shuts down the engine through interaction with the engine governor. In such prior systems, the deactivation of a shut-off solenoid in the circuit provides shut down of the engine through the governor. In such a system, the shut-off solenoid remains activated during the entire time that the engine is running.

In certain types of circuits, the key operates a switch which, upon closing, closes a set of contacts to provide power from a battery to the remaining portion of the circuit. In such a typical circuit, the opening of the switch by turning of the key opens such contacts. At the time of the opening of such contacts, it will be understood that the engine and the alternator are still turning, so that the alternator continues to produce electric current. This causes a surge of current to pass through the system, with the possible result that some of the components of the system, i.e., for example, light bulbs, are rendered inoperable.

SUMMARY OF THE INVENTION

It is the object of this invention to overcome one or more of the problems as set forth above.

In accordance with the present invention, there is provided an electrical circuit for use with an engine. The circuit comprises an electrical power source, and openable and closable contact means. Further included are engine shut-off solenoid means operable to shut down the engine upon actuation thereof. Means operatively connect the contact means and engine shut-off solenoid means for providing that with the contact means initially opened, the shut-off solenoid means is activated.

BRIEF DESCRIPTION OF THE DRAWING

Other objects of the invention will become apparent from a study of the following specification and drawing, which is a schematic representation of the circuit of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, the overall electrical circuit **10** which is the subject of this invention is shown. The circuit **10** is for use with an engine having electrical current generating means in the form of an alternator **12**, rotation of the crank shaft of the engine rotating such alternator to provide an alternator output. The circuit includes a battery **14**, and a line **16** extends from the positive terminal of the battery to the remainder of the circuit, the line **16** having therein contact means **18** in the form of normally open contacts, and a circuit breaker **20**. A line **22** communicates with line **16**, such line including a circuit breaker **24**, and leading to

contact means in the form of a key-operated switch **26**. A terminal **28** of switch **26** has a line **30** extending therefrom to ground, and includes a relay **32**. Such relay **32** is operatively connected with the contacts **18** so that energizing of the relay **32** by application of electric current therethrough closes the normally open contacts **18**, and de-energizing of such relay **32** provides opening of the contacts **18**. The other terminal **34** of the switch **26** has leading therefrom another line **36**, leading to ground, such line **36** including a relay **38**. Such relay **38** is operatively connected with normally open contacts **40** placed in a line **42** communicating with line **16** and with ground, an engine starter solenoid **44** also being included in such line **42**. Energizing of the relay **38** by application of electric current therethrough closes the normally open contacts **40**, and de-energizing of such relay **38** provides opening of the contacts **40**.

A line **46** is in parallel with line **30** and includes a relay **48**. The relay **48** is in operative association with normally closed contacts **50** placed in a line **52** leading from one terminal of the alternator **12** to ground. Energizing of the relay **48** will provide opening of the contacts **50** and de-energizing of the relay **48** will provide closing of the contacts **50**. The line **52** also includes another relay **54** in operative association with normally open contacts **56** placed in another line **58** communicating with line **16** through a breaker **57** and extending to ground. Energizing of the relay **54** provides closing of the contacts **56**, and de-energizing of the relay **54** provides opening of the contacts **56**. The line **58** also includes an engine shut-off solenoid **60**.

The output side of the alternator **12** communicates with the line **16** beyond the contacts **18** by means of a line **62**.

A number of diodes **64** are in the circuit to ensure proper direction of current therewithin as necessary.

In operation, with the engine, for example, at rest, and with the key off, the circuit elements are in the states shown in the drawing. Turning of the key to the on position by the operator of the vehicle first provides current from the battery **14** to terminal **28**, of the switch **26**. Thus, power is supplied to energize the relay **32**, closing the contacts **18** to provide power to the remainder of the circuit. At the same time, power is supplied to the relay **48** so that the contacts **50** are opened to prevent energization of relay **54**. Further turning of the key of switch **26** will provide current to terminal **34** and energize relay **38**. Such action will close contacts **40** and thus energize the starter solenoid **44** to start the engine. Once the engine is started, the key is released so that only terminal **28** will be energized. As a result, relay **38** is de-energized, contacts **40** are opened and starter solenoid **44** is de-activated.

When engine shut-down is required, the key operated switch **26** is moved to the position shown in the drawing, so that relay **48** is de-energized, and contacts **50** are closed. With the engine still turning, the alternator continues to provide an output in line **52**. Thus, relay **54** is energized, in turn closing contacts **56**, to in turn energize the shut-off solenoid **60**. upon initial shut-down of the engine, but before the engine has achieved a full shut-down state, the alternator **12** continues to turn so that an output continues to exist in the line **52**. Thus, continued activation of the shut-off solenoid is assured until the engine completely stops. Also, because of the communication of line **52** with line **30** to a connecting line **66**, the relay **32** is still being energized to keep the contacts **18** closed, eliminating any of the problems of

surge discussed above. Thus, as long as the switch **26** is closed or the alternator **12** is providing an output, the relay **32** is energized, keeping the contacts **18** closed.

The shut-off solenoid **60** thus shuts down the engine upon activation thereof. It will be seen that upon opening of the switch **26**, the shut-off solenoid **60** is activated and remains so until such time as the engine (and alternator driven thereby) completely stops. Solenoid **60** is activated against an internalspring force, and will automatically return to the de-activated state until such time as the cycle is repeated. It will thus be seen that contrary to prior systems, the shut-off solenoid **60** is deactivated while the engine is running, and is activated only during the time when the switch **26** is open and the engine comes to a complete stop because of the sequential action of closing contacts **50**, energizing relay **54**, and closing contacts **56**.

The embodiments of the invention is which an exclusive privilege or property is claimed are defined as follows:

1. An electrical circuit for controlling an engine, comprising:

(a) electrical power source means for starting and turning off the engine;

(b) an engine shut-off solenoid being energizable only after turning off the engine; and

(c) means for generating current on start-up of the engine and after turning off the engine and for energizing said shut-off solenoid with said current that is generated after the turning off the engine.

2. An electrical circuit according to claim **1**, wherein said generating means is electrically coupled to said power source means during shut-off of the engine.

3. An electrical circuit according to claim **1**, wherein said means for generating includes:

(a) first relay means for controlling the closing of a path to said shut-off solenoid in response to engine turn-off; and

(b) second relay means for closing the path to said shut-off solenoid in response to the current being generated after engine turn-off.

4. An electrical circuit according to claim **3**, wherein said second relay means includes:

(a) a first relay having contacts; and

(b) a second relay having contacts.

5. An electrical circuit for controlling an engine, comprising:

(a) electrical power source means for starting and turning off the engine;

(b) means for generating current on start-up of the engine and after turning off the engine;

(c) energizable means for shutting off the engine;

(d) first relay means for controlling the closing of a path from said current generating means to said energizable means and said power source means in response to turning off the engine; and

(e) second relay means for closing the path from said current generating means to said energizable means and said power source means in response to the current being generated after turning off the engine.

6. An electrical circuit according to claim **5**, wherein said second relay means includes:

(a) a first relay having contacts and being connected to said current generating means; and

(b) a second relay having contacts and being connected to said current generating means.

7. An electrical circuit according to claim **6**, wherein said first relay means includes a third relay having contacts, said third relay being connected to said power source means and said contacts of said third relay being connected to said first relay.

8. An electrical circuit according to claim **5**, wherein said current generating means includes an alternator.

9. An electrical circuit according to claim **5**, wherein said power source means includes:

(a) a battery; and

(b) an openable and closeable switch connected to said battery.

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